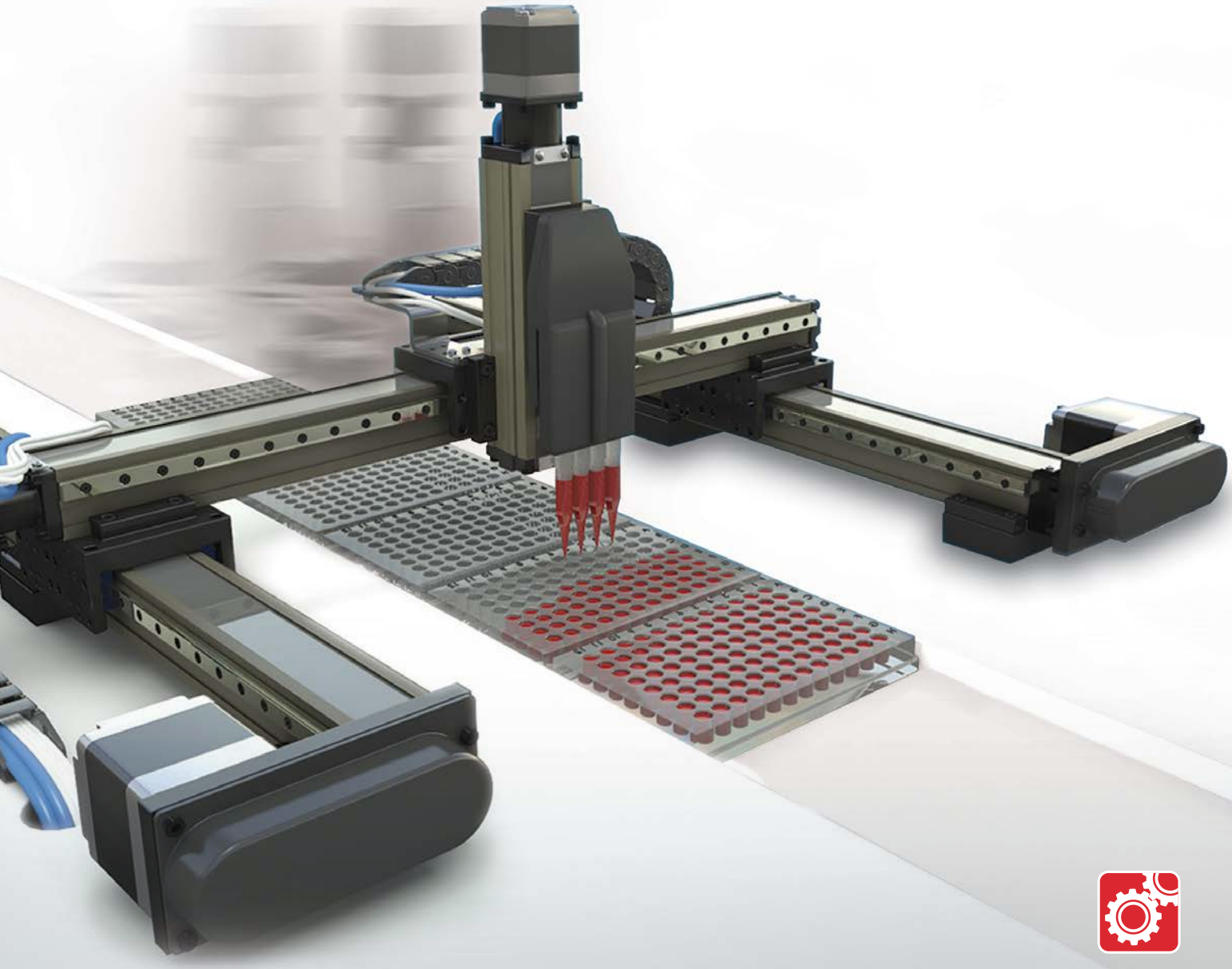
LDA Belgium

PBC Linear®

ML Series

Miniature Linear Actuators

Linear Motion Solutions



Configure Online at
pbclinear.com

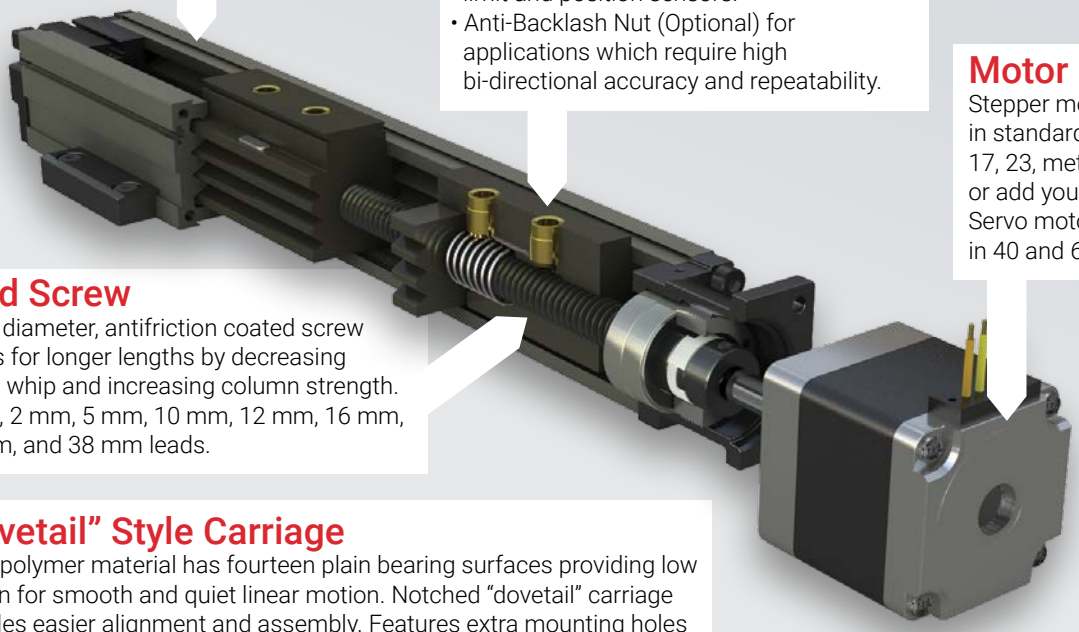
+1.800.962.8979

ML Series Overview

Rail/Housing
SIMO® process ensures precision mounting, accurate installation and lightweight composition. Ceramic Coated Body for corrosion resistance and long life.

Nut
- Brass Inserts for system mounting and integrity.
- Built-in magnet accommodates home, limit and position sensors.
- Anti-Backlash Nut (Optional) for applications which require high bi-directional accuracy and repeatability.

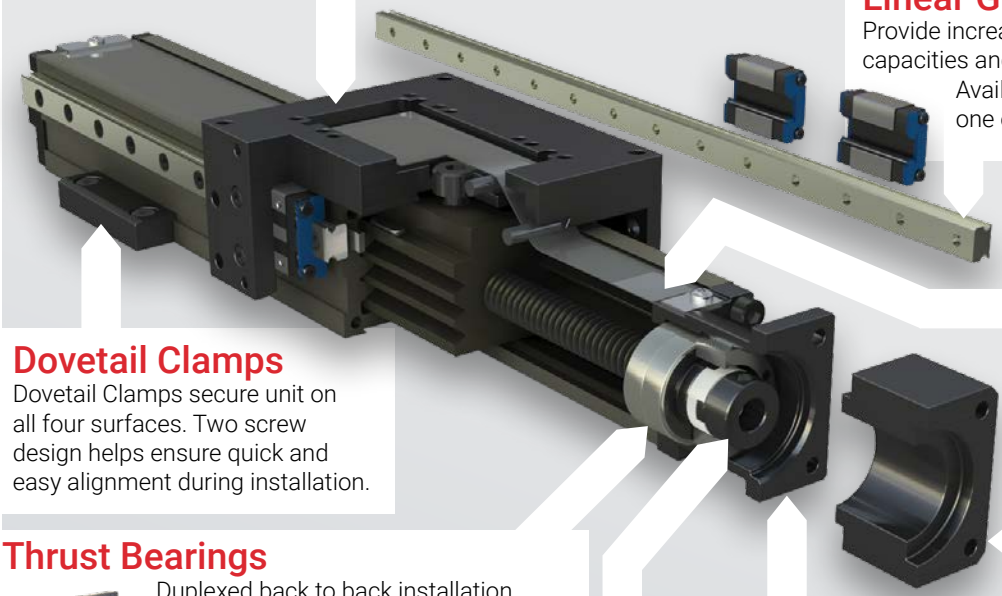
Motor
Stepper motors available in standard NEMA 11, 14, 17, 23, metric frame sizes or add your own.
Servo motors available in 40 and 60 mm motors.



Lead Screw
Large diameter, antifriction coated screw allows for longer lengths by decreasing screw whip and increasing column strength. 1 mm, 2 mm, 5 mm, 10 mm, 12 mm, 16 mm, 25 mm, and 38 mm leads.

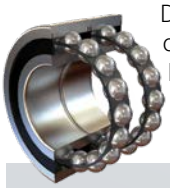
"Dovetail" Style Carriage
PTFE polymer material has fourteen plain bearing surfaces providing low friction for smooth and quiet linear motion. Notched "dovetail" carriage provides easier alignment and assembly. Features extra mounting holes for ease of installation and multi-axis assemblies.

Linear Guide Supports
Provide increased load and moment capacities and overall rigidity to the system. Available single or dual rails with one or two runnerblocks per rail.



Seal Strip
Ultra-wear-resistant MDS nylon prevents particulates or contaminants from entering or exiting actuator.

Dovetail Clamps
Dovetail Clamps secure unit on all four surfaces. Two screw design helps ensure quick and easy alignment during installation.

Thrust Bearings


Duplexed back to back installation of deep groove ball bearings provides high stiffness and allows for increased thrust loads, rotational speed and repeatability.

Motor Mount Adapter (MLC)
Adapter plate designed to fit any manufacturer's motor. Compensates for variations in pilot diameter, depth, shaft diameter, length and mounting screw patterns.

Motor Mount
Specially constructed with an optimized length, resulting in an overall shorter system with PBC Linear™ brand stepper motors.

Internal Coupling
Rigid polymer insert coupling for increased smoothness and minimal backlash.

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ML Series Linear Actuators

ML Advantage

- **Small, Compact Profile** - 28 x 32 mm
- **Patent Pending SIMO® Process**
  Ensures precision mounting, accurate installation and lightweight composition.
- **Lead Screw Driven** - High accuracy and precise repeatability
- **Multi-Axis Configurations**
- **Long Travel Lengths -** Up to 650 mm

MLC Series
Motor Mount Only

Specially designed motor mounts and couplings for easy mounting and extended life.

MLD Series
Hand Driven (Shaft or Knob)

Adjustable hand operated knob and brake for precision control.

MLB Series
Motor Driven

Pre-mounted stepper or servo motors.

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Accessories

Motor Mount Assembly

Riser Plates

Side Motor Mount Cover

Seal Strip

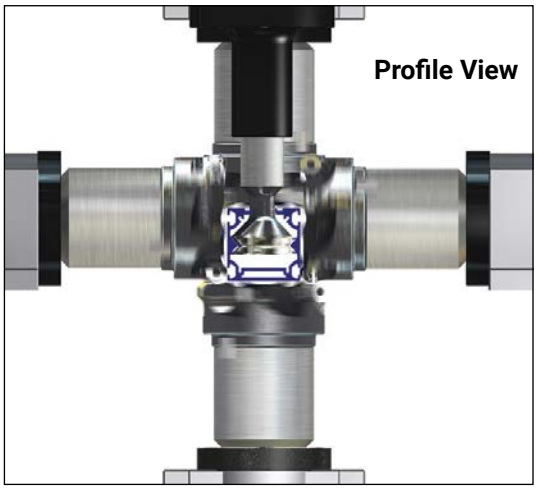
Sensors

Stepper and Servo Motors

Machine tools are built on precision machined castings or weldments. Why shouldn't your actuator be built the same?

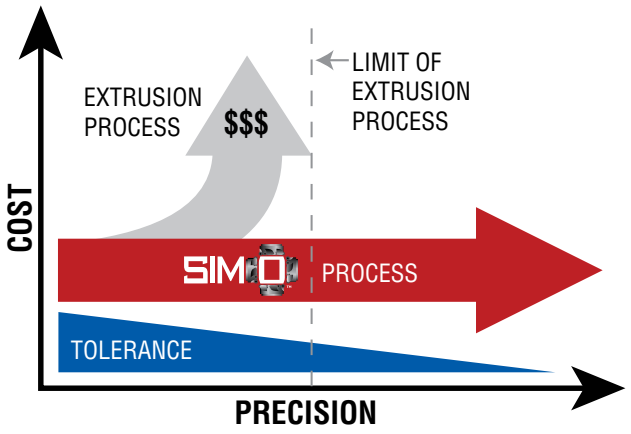
PBC Linear has revolutionized traditional machining with the patent pending SIMO™ (Simultaneous Integral Milling Operation).

SIMO process uses synchronized cutters, eliminating built-in extrusion variances by machining all critical edges concurrently in one pass. This ensures tight tolerances, limited variance and a remarkably straight and repeatable surface at negligible additional cost!



Typical Aluminum Extrusion Issues

The typical aluminum extrusion process produces a natural bow, twist and variance. Costly straightening and aligning is traditionally used to combat this variance, resulting in a semi-straight aluminum extrusion that drives the cost up.



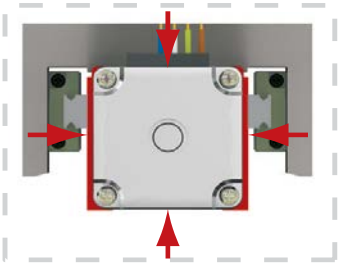
As tolerances get tighter, the cost of machining with conventional processes increases dramatically over the SIMO process.

- **Patent Pending Machining Process**
- **High Precision Mounting Surfaces**
- **Tight Tolerances ± 0.025mm (0.001 in)**

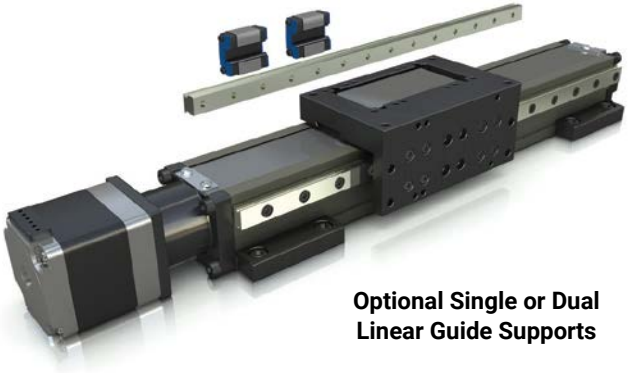
ML Advantage

Using the machine tooled precision and rigid surfaces sustained by the SIMO™ process, the ML's bridge gantry design can support 1 or 2 linear guides on the sides of the ML.

Bridge Gantry Design



4X Reference Qualified Edge



Optional Single or Dual Linear Guide Supports

These supports work together to increase load capacities and sustain stability while utilizing re-circulating caged-ball technology to provide smooth and quiet linear motion guidance.

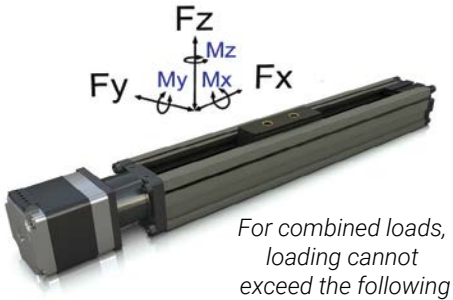
Technical Data

ML SERIES - Carriage only					
Size		mm	28 x 32	in	1.10 x 1.26
MAX Load - Lite Preload - anti-backlash - Standard	Fx	N	44 267	lbf	10 60
	Fy		107		24
	Fz		178		40
MAX Moments	Mx	Nm	1.4	lbf-in	12.4
	My		1.4		12.4
	Mz		1.4		12.4
Bending Moment of Inertia (second moment of area)	Iy	cm^4	2.4	in^4	0.058
	Iz		4.4		0.106

See page 24 for technical data on linear guide supports

Base Weight without Motor	Kg	0.060	lbf	0.130
Add for 100 mm of stroke		0.150		0.340
Total Carriage Mass		0.020		0.044
Total Carriage Mass & Top Plate		0.059		0.130
Coefficient of Friction		0.19		
MAX Speed	m/s	1	in/s	75
MAX Stroke Length	mm	650	in	25.6
MIN Stroke Length		5		0.200
Nominal Screw Diameter		10.0		0.375
Max RPM		3000		
No Load Torque **Nut** - Lite Preload - anti-backlash - Normal Preload - anti-backlash - Standard	Nm	0.0565 0.1060 0.0070	lbf-in	0.500 0.940 0.062
Linear Guide Supports - Single Linear Guide - Dual Linear Guides	Nm	0.017 0.034	lbf-in	0.15 0.30
Seal Strip - with Seal Strip - without Seal Strip	Nm	0.028 0	lbf-in	0.25 0
Screw Lead Accuracy*	mm/mm	0.0006	in/in	0.0006
Normal Operating Temperature (Wider ranges available) MIN	°C	18	°F	32
MAX		98		176

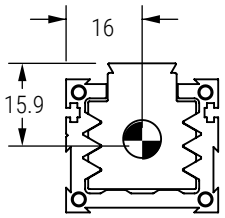
*Higher accuracies are available to 0.0001 mm/mm (in/in). Contact manufacturer for details.
Specifications are subject to change without notice.



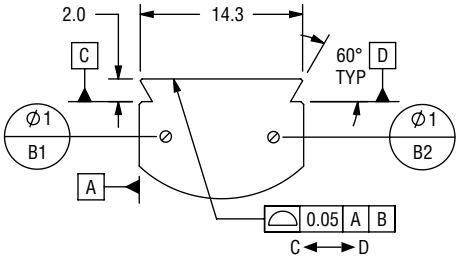
For combined loads, loading cannot exceed the following formula.

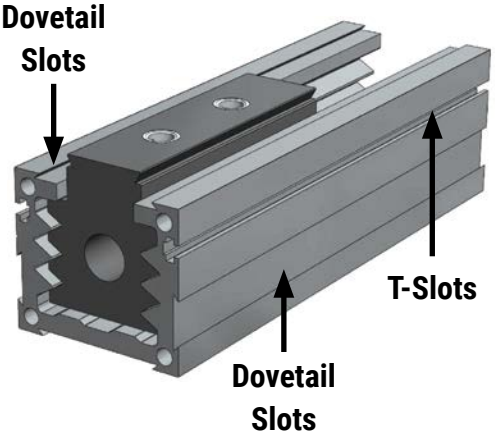
$$\frac{Fy_A}{Fy}+\frac{Fz_A}{Fz}+\frac{Mx_A}{Mx}+\frac{My_A}{My}+\frac{Mz_A}{Mz}<=1$$

Center of Gravity for Moment Calculations

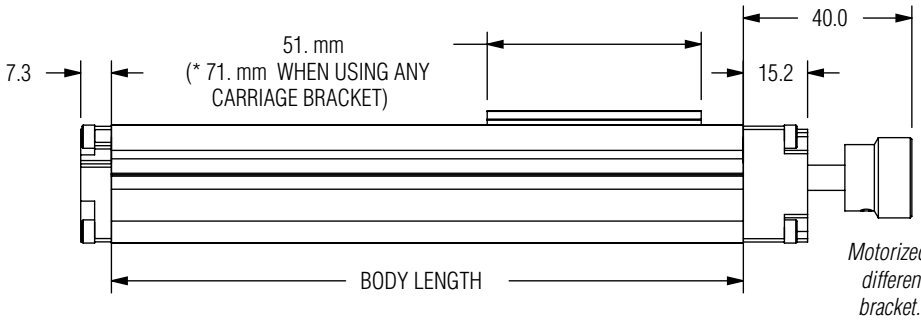


External Dovetail Easy Sketch





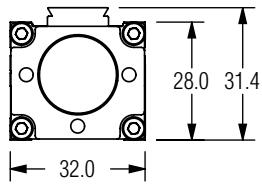
Dimensional Data

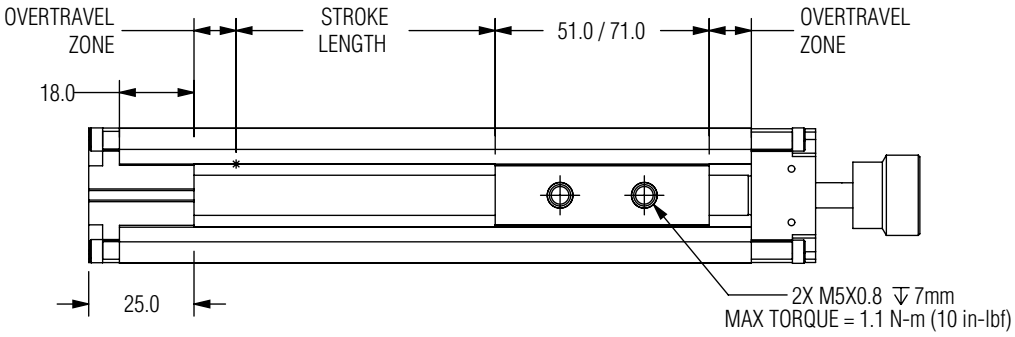


Motorized units use a different drive end bracket. See motor section for more details.

NOTE: BODY LENGTH = STROKE + *CARRIAGE LENGTH + (2X OVER TRAVEL) + 18mm

CARRIAGE WITH DOVETAIL





RECOMMENDED OVERTRAVEL PER SIDE

Knob or Hand Crank = 5mm
Stepper Motor = 10mm
Servo Motor = 20mm

How to Calculate Body Length

1) Enter 19 mm

2) Select (5, 10 or 20 mm) for overtravel on idle end *(See recommended overtravel above.)*

3) Specify stroke length in mm

4) Select (51 or 71 mm) for carriage length

5) Select (5, 10 or 20 mm) for overtravel on idle end *(See recommended overtravel above.)*

6) Add amounts together and enter SUBTOTAL

7) Enter TOTAL BODY LENGTH *(Round to nearest 10 mm)*

8) When ORDERING enter TOTAL BODY LENGTH in BODY LENGTH column.

BODY LENGTH CALCULATION TABLE		Example	
IDLE END CAP = 19mm	19	19	1
OVERTRAVEL IDLE END (5, 10 or 20mm)		10	2
STROKE LENGTH		155	3
CARRIAGE LENGTH (51 or 71mm)		71	4
OVERTRAVEL DRIVE END (5, 10 or 20mm)		10	5
(Add Amounts 1-5) + ENTER SUBTOTAL (mm) =		265	6
TOTAL BODY LENGTH *(Round Subtotal to nearest 10mm)*		270	7

8

ORDERING GUIDE

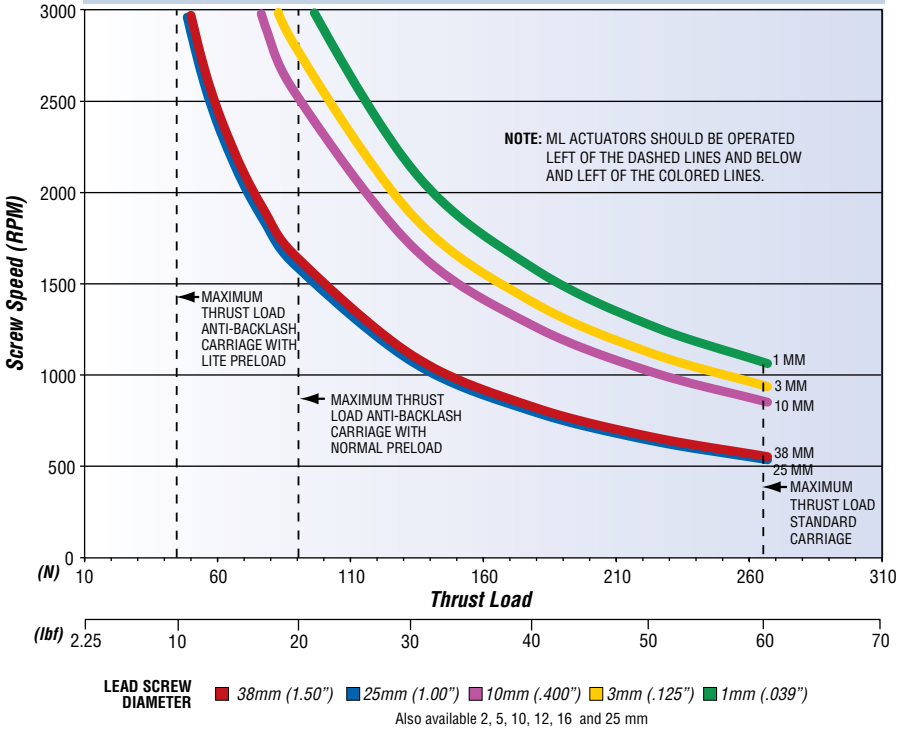
MLC028D-	X	XX	X	X	X	- 0270 -	X	X
Series	**Linear Guide Supports**	**Leads**	**Nut Type**	**Seal Strip**	**# of Carriages**	**Body Length** mm	**Motor Location**	**Configuration**
ML Series with motor lead screw driven 28 x 32 mm	**0** No external Rail **1** 1 Rail + 1 Runner Block* **2** 1 Rail + 2 Runner Block* **3** 2 Rail + 1 Runner Block/rail **4** 2 Rail + 2 Runner Block/rail	**AH** 1 MM **AG** 2 MM **AX** 5 MM **AJ** 10 MM **BD** 12 MM	**2** Standard Nut **4** Anti-backlash (light preload) **6** Anti-backlash (normal preload)	**0** None **1** With Seal strip	**1** 1 Carriage **2** 2 Carriages **3** 3 Carriages **4** 4 Carriages		**S** Straight (in-line) **L** Left **R** Right **B** Bottom **T** Top	**0** Standard

Performance Data

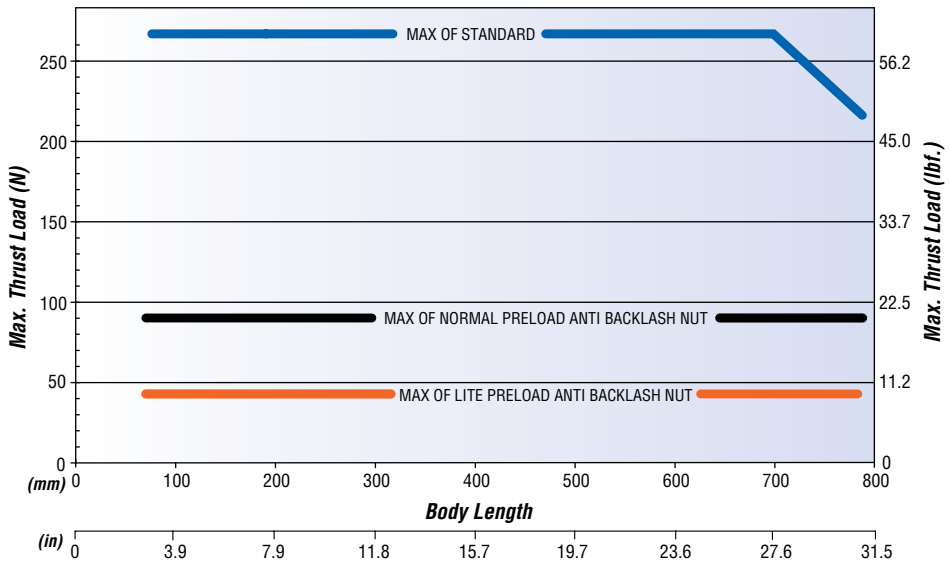
The load rating and system speed must both be accounted for when sizing a lead screw system. The nut threads and screw threads form a plane bearing system.

The PV limit of a polymer material is the point at which friction-generated heat can no longer be expelled at a rate to prevent the material from overheating. Such overheating while under stress can cause permanent deformation of the material. Ignoring how the system's speed and loading relate to the nut material's PV rating can lead to dramatically shorter thread life. The primary modes of failure for lead screw systems are wear and PV. By staying within the PV envelope of the screw and nut, one can ensure long life of the nut without premature wear.

PV Rating - ML Lead Screw & Nut



Maximum Thrust Load Based on Nut Capacity & Column Loading



Torque to Raise Load

$$T_L \text{ (Nm)} = \frac{\text{Load (N) x Lead (mm)}}{2\pi \text{ x Efficiency x } 1000}$$

$$T_L \text{ (in-lbf)} = \frac{\text{Load (lbf) x Lead (in)}}{2\pi \text{ x Efficiency}}$$

Performance Characteristics		Lead Screw mm *(in)*				
		38 (1.50)	25 (1.00)	10 (.400)	3 (.125)	1 (.039)
Max, Travel Speed	mm/s (in/s)	1905 (75)	1270 (50)	508 (20)	159 (6.25)	50 (1.95)
Screw Diameter	mm (in)	10 (0.375)	10 (0.375)	10 (0.375)	10 (0.375)	10 (0.375)
Screw Efficiency (See formula to left)		81%	82%	77%	57%	26%

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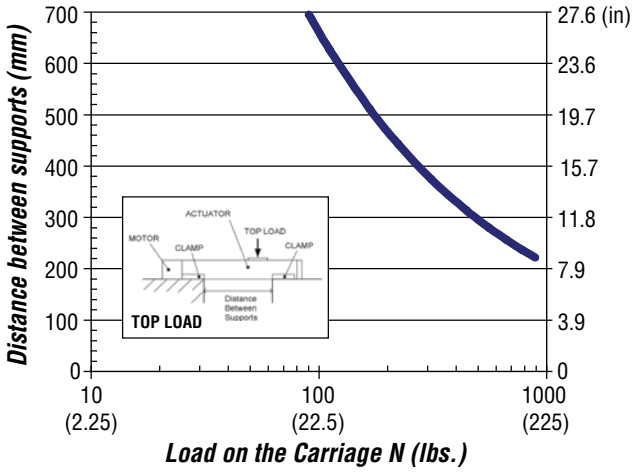
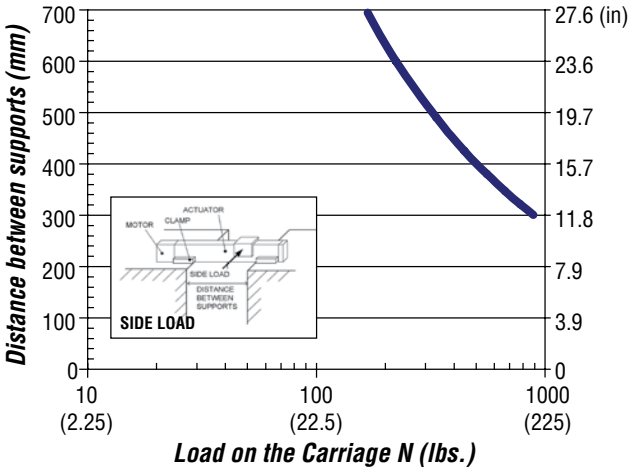
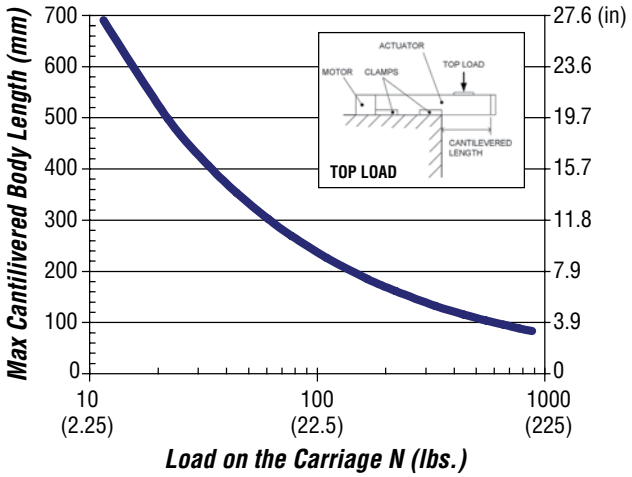
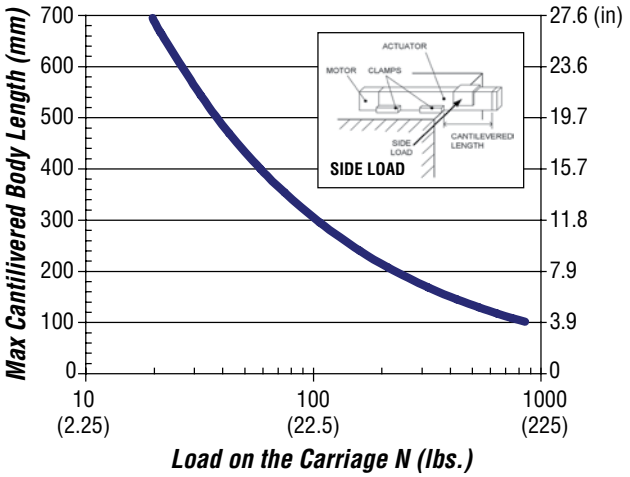
Distance Between Supports



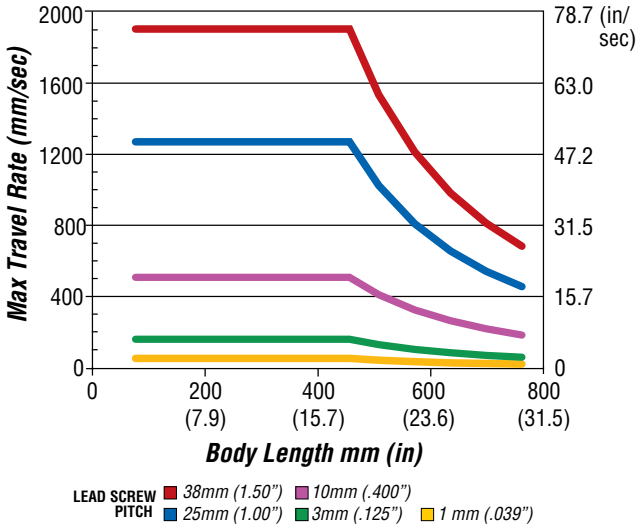


Maximum Cantilevered Length

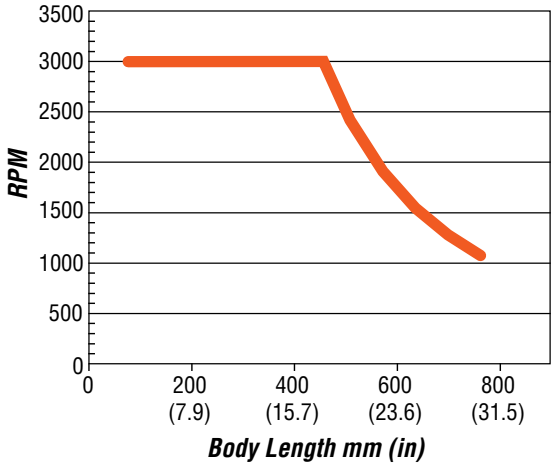




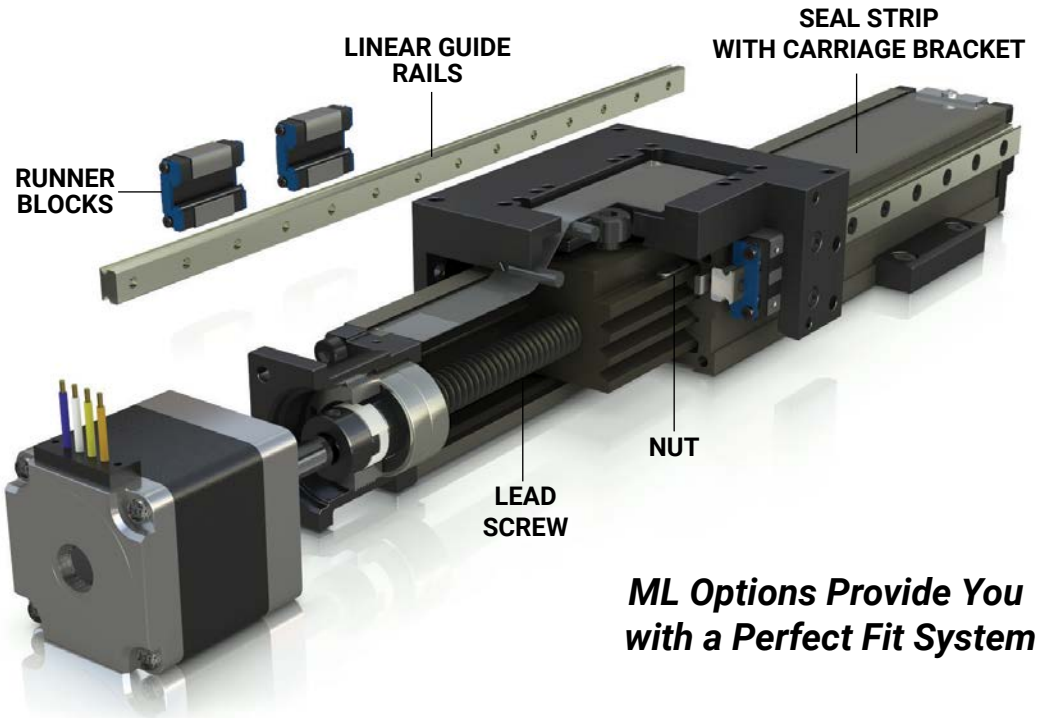
Maximum Travel Speeds



80% of Critical Speed



Ordering Options



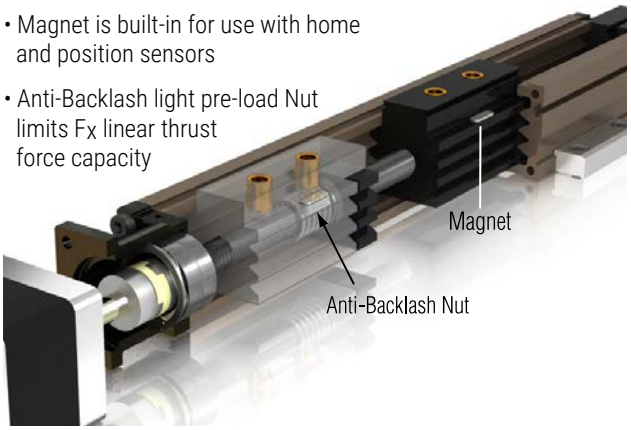
ML Options Provide You with a Perfect Fit System

Lead Screw

- Large 10 mm diameter lead screw reduces whip and increases column strength allowing longer stroke lengths
- Lead options*: 1, 2 , 5 , 10 , 12, 16 and 25 mm. 3 mm (0.125"), 10 mm (0.400"), 25 mm (1"), 38 (1.5")
  **Contact manufacturer for other available sizes*
- **Nominal Lead Screw Diameter** = 10 mm (0.375")
- **Screw Interia** = 4.169 x 10^{-6} kg-m^2/m
  1.5 x 10^{-5} oz.-in.$sec.^2$/in.)
- **Lead Screw Length** = Body Length + 32.27 mm

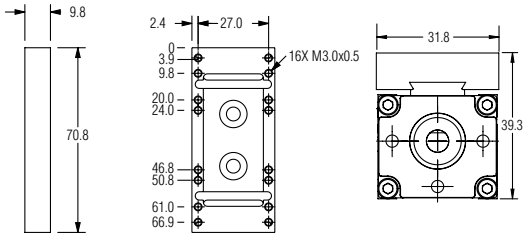
Nut Type

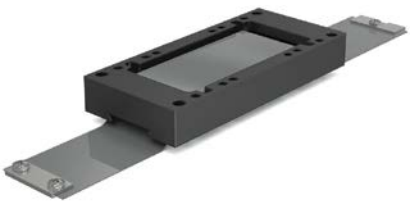
- Standard nut F_X=262 N (60 lb) or anti-backlash nut F_X=44 N (10 lb)
- Optional anti-backlash nut - ideal in applications requiring high bi-directional accuracy and repeatability
- Magnet is built-in for use with home and position sensors
- Anti-Backlash light pre-load Nut limits F_X linear thrust force capacity



Seal Strip with Carriage Bracket

- Ultra wear-resistant molybdenum disulfide impregnated nylon
- Prevents debris from entering or exiting actuator
- Seal strip is 725mm in length *(Can be cut shorter using sharp pair of scissors.)*





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ML Actuator Build, Mount, Use

Build Your ML Actuator

Step 1
Configure Your System Axis

A. Determine if you need an external linear guide for support *(p 10)*

B. Calculate the body length *(p 5)*

Step 2
Choose the Drive Method

A. Motor pre-mounted and tested by PBC Linear? ➡ MLB *(p 16)*

B. Ready to mount your own motor? ➡ MLC *(p 12)*

C. Driven by hand? ➡ MLD *(p 14)*

Step 3
Choose How to Mount Axis

A. Choose dovetail clamps or riser plates (Use riser plates with NEMA 17 and 23 motors) *(p 21)*

Step 4
Choose End of Travel and Home Limit Switches/Sensors

A. Determine mounting type/location (bracket type)

B. Choose from list of compatible sensors

Repeat 1-5 for Each Axis

Step 5
Order Your System
1-800-962-8979 or
1-815-389-5600

Questions?
Call an Application Engineer
1-888-777-0556

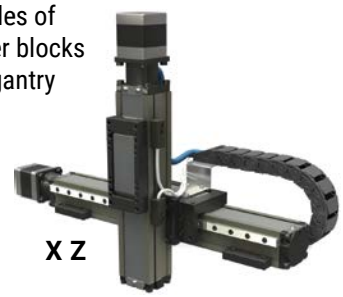
Multi-Axis Mounting

ML actuators are designed to perform well in X Y and other Cartesian arrangements. The actuator body forms a strong beam with higher moment loading capacity. Special dovetail slots on all sides allow the actuators to be mounted on their bottom surface or on either side.

X Y

Carriage brackets and special wedge mounting clamps allow for precise and rigid mounting arrangements. Linear guides can be installed on one or both sides of the actuator with one or two runner blocks on each rail for greater rigidity in gantry applications.

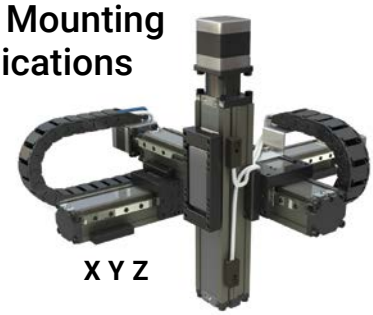
Multi-axis gantries can also be created by combining the ML with other actuators such as the PL or MT Series.



X Z

Superior Multi-Axis Mounting for Compact Applications

- Medical
- Biotech
- Instrument Automation
- Packaging
- Pick & Place
- Semi-conductor
- Scanning



X Y Z

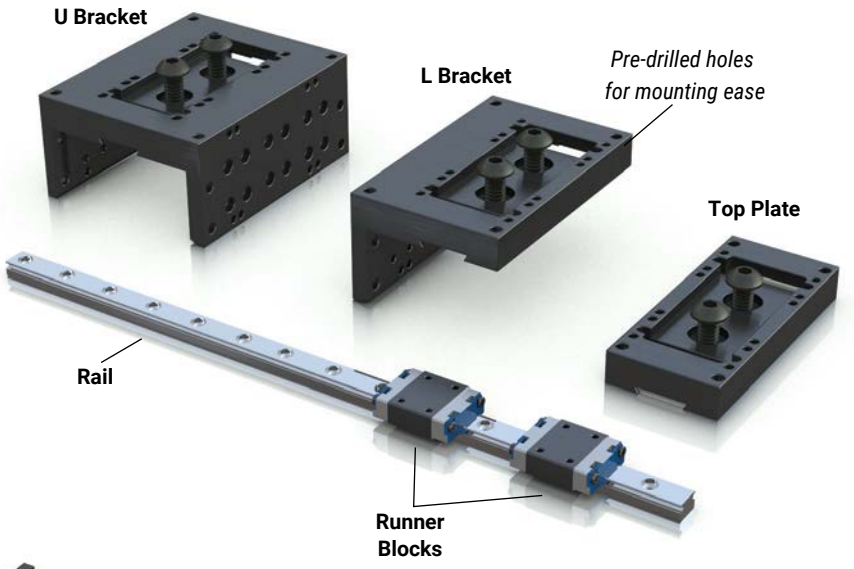
MULTI-AXIS
MTB Series
with MLB

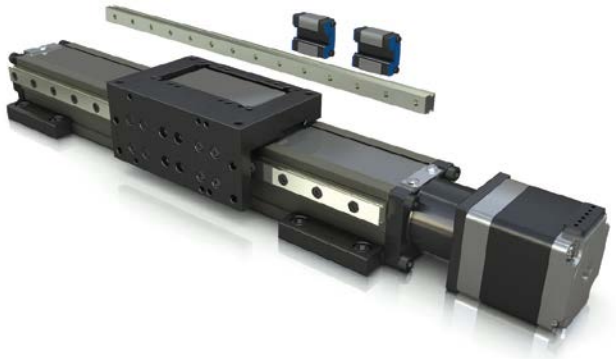
ML Applications

The ML miniature actuator has a combination of compactness and (60 lbf) 265 N pound thrust power gives this actuator an edge for automation applications where space is critical. Plus, the SIMO® machined rail surface and zero backlash lead screw assembly ensures accuracy and precision for syringe pumps and optical control applications.

Linear Guide Supports

The ML series features the unique option for dual external linear guides (also available with single linear guide option). These re-circulating ball runner blocks assure high speed precision as well as enhanced load capacities and stability.





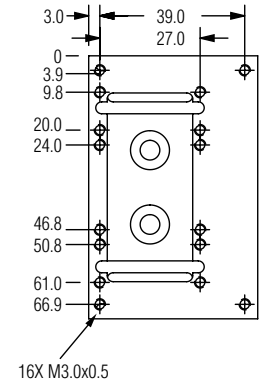
Support Options to Create Variable Levels of Performance

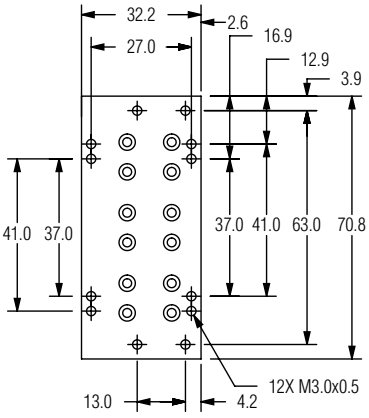
Technical Data Linear Guide Supports				(1) Single # of runner blocks on each guide		(2) Dual # of runner blocks on each guide			(1) Single # of runner blocks on each guide		(2) Dual # of runner blocks on each guide	
				1	2	1	2		1	2	1	2
MAX Load	Anti-Backlash Lite Preload	Fx	N	44	44	44	44	lbf	10	10	10	10
	Anti-Backlash Normal Preload			89	89	89	89		20	20	20	20
	Standard Nut			267	267	267	267		60	60	60	60
		Fy		180	250	445	890		40	56	100	200
		Fz		267	356	445	890		60	80	100	200
MAX Moments		Mx	Nm	1.8	3.6	8.6	18	lbf-in	16	32	76	160
		My		1.8	5.0	3.6	10		16	44	32	88
		Mz		1.8	5.0	3.6	10		16	44	32	88
Bending Moment of Inertia (Second Moment of Area)		Iy	cm^4	2.4	2.4	2.4	2.4	in^4	0.058	0.058	0.058	0.058
		Iz		4.4	4.4	4.4	4.4		0.106	0.106	0.106	0.106
Base Weight without Motor			Kg	0.127	0.136	0.195	0.205	lbf	0.280	0.300	0.430	0.450
Add for 100 mm of Stroke				0.180	0.180	0.210	0.21		0.400	0.400	0.460	0.460
Total Carriage Mass			Kg	0.109	0.117	0.159	0.175	lbm	0.240	0.257	0.350	0.385
Coefficent of Friction				0.190		0.010			0.190		0.010	

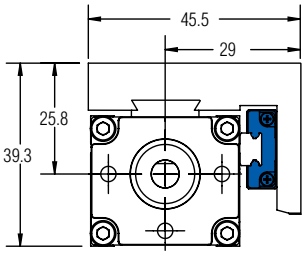
Note:
1. Moment arms for calculating moments should be measured from the center of the extrusion
2. Limit switches must be used in order to prevent the carriage from contacting the actuator end blocks, resulting in damage
3. Servo drive system, recommended overtravel of 20 mm
4. Stepper motors or manual hand cranks system, add 5 mm of over-travel

Dimensional Data

Single Linear Guide Supports





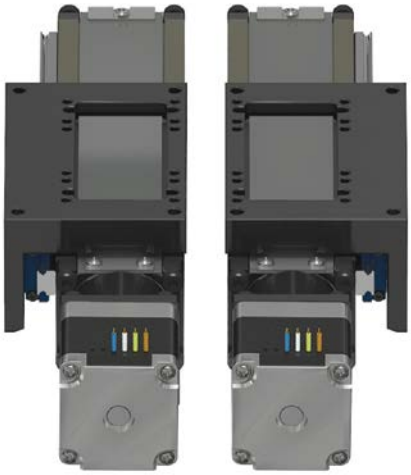


INCLUDES:

(1) rail, (1) runner block & aluminum alloy L shaped carriage bracket

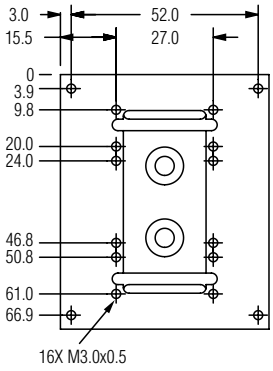
- or -

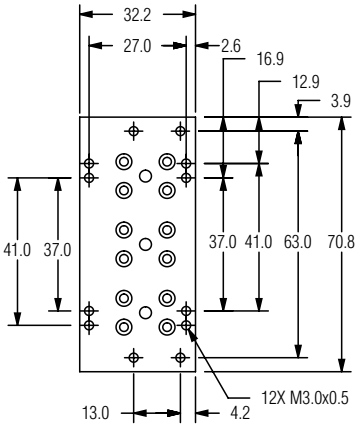
(1) rail, (2) runner blocks & aluminum alloy L shaped carriage bracket

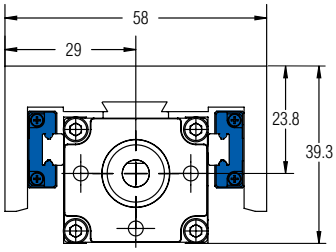


LEFT **RIGHT**

Dual Linear Guide Supports







INCLUDES:

2) rails, (1) runner block & aluminum alloy U shaped carriage bracket

- or -

(2) rails, (2) runner blocks & aluminum alloy U shaped carriage bracket

MLC Series (Motor Mount Only)

- **Includes motor mount with coupling**
- **Includes motor spacer (if required)**
- **Precision machined body**
- **Small, compact design**
- **Smooth and quiet operation**
- **High acceleration, speed and rigidity**

PBC Linear stepper motors do not require a spacer due to the shorter shaft length. A spacer is required for any other manufacturer's motor. The spacer compensates for several dimensions which commonly vary amongst motor manufacturers (shaft diameter, shaft length, pilot diameter, pilot depth, bolt hole diameter, bolt type).

MLC Ordering Guide

MLC028D –	X	XX	X	X	X
Series	**Linear Guide Supports***	**Leads**	**Nut Type**	**Seal Strip**	**# of Carriages**
ML Series with motor mount 28 x 32mm	0 No External Rail 1 (1) Rail, (1) Runner Block - XY-2 Brkt (R) 2 (1) Rail, (2) Runner Blocks - XY-2 Brkt (R) 3 (2) Rail, (1) Runner Block - XY-3 Brkt 4 (2) Rail, (2) Runner Blocks - XY-3 Brkt 5 (1) Rail, (1) Runner Block - XY-2 Brkt (L) 6 (1) Rail, (2) Runner Blocks - XY-2 Brkt (L) 7 No Seal Strip - XY-1 Brkt	AH 1 mm AG 2 mm AX 5 mm AJ 10 mm BD 12 mm AF 16 mm AW 25 mm	2 Standard Nut 4 Anti-backlash (light preload)	0 None 1 With Seal Strip & XY Bracket	1 1 Carriage 2 2 Carriages 3 3 Carriages 4 4 Carriages NOTE: Contact manufacturer before ordering multiple carriages.

*(L) = Left (R) = Right

#### –	X	X	X	X	X	0
Body Length	**Motor Location**	**Motor Frame Size**	**Shaft OD**	**Coupling Material**	**Spacer Config**	**Config.**
mm See page 11 for body length calculation table EX: 90mm = 0090 250mm = 0250	S Straight (in-line) L Left R Right B Bottom T Top	A NEMA 8 (20mm) B NEMA 11 (28mm) C NEMA 14 (35mm) E Metric 40 F NEMA 17 (42mm) G NEMA 23 (56/58mm)	A 3mm B 0.125 in C 4mm D 0.1875 in E 5mm F 6mm G 0.25 in H 0.3125 in J 8mm	1 Acetal	A Standard	0 Standard

At time of order, customer must declare their pilot diameter, shaft length and mounting hole pattern of the matching motor so that the proper spacer can be included.

FINAL PART #	MLC028D	-	X	XX	X	X	X	-	XXXX	-	X	X	X	X	X	0

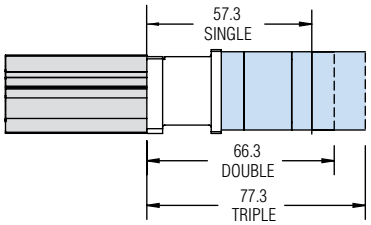
NOTE: Not all combinations are possible. Contact manufacturer for available combinations. Body lengths are available in 1 mm increments up to 701 mm. Standard lengths are multiples of 10 mm. When possible round up to nearest multiple of 10 mm. NEMA 11 stepper motors typically do not have enough torque to drive the anti-backlash nuts. Customers are responsible for doing torque calculations to ensure the motor is properly sized. Specifications are subject to change without notice.

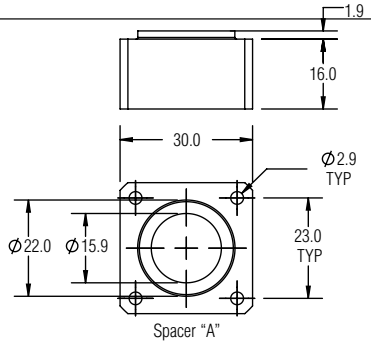
Motor Mount Assembly

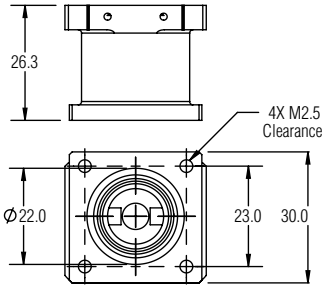
ML Series Actuator Motor Mount & Spacer PBC Stepper Motor

Assembly Dimensions	Spacer A	Motor Frame Size

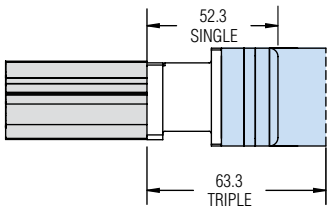
Recommended for **NEMA 11** Stepper Motor

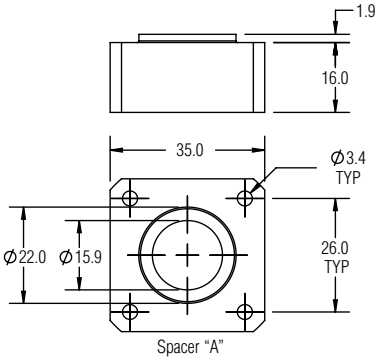


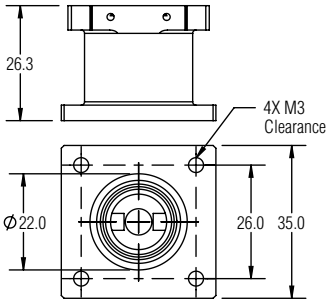




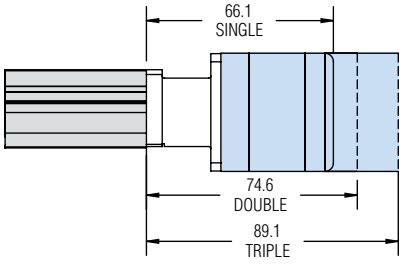
Recommended for **NEMA 14** Stepper Motor

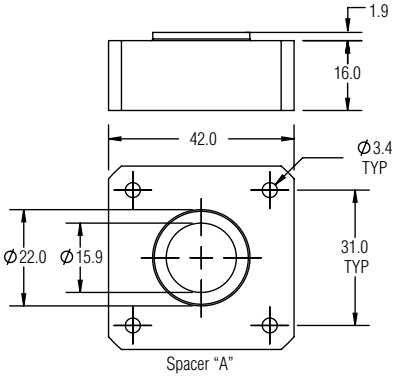


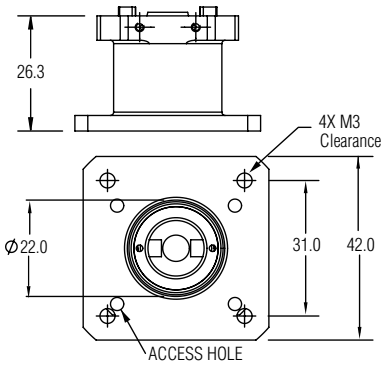




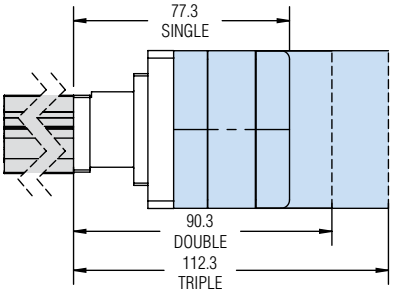
Recommended for **NEMA 17** Stepper Motor

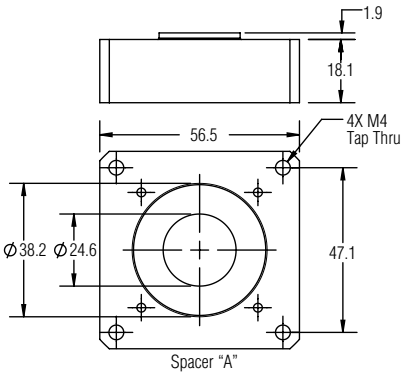


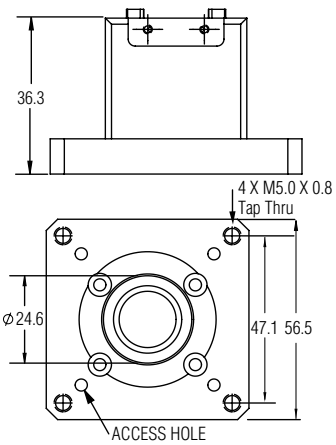




Recommended for **NEMA 23** Stepper Motor







MLD Series (Hand Driven shaft or knob)

- **Perfect for hand-operated precision control**
- **Manual brake optional**
- **Textured knob for both positioning and braking**
- **Precision machined body**
- **Small, compact design**
- **Great repeatability**

MLD Ordering Guide

MLD028D	-	X	XX	X	X	X

Series	Linear Guide Supports	Leads	Nut Type	Seal Strip	# of Carriages
ML Series with knob/drive lead screw driven 28 x 32 mm	**0** No External Rail **1** (1) Rail, (1) Runner Block - XY-2 Brkt (R) **2** (1) Rail, (2) Runner Blocks - XY-2 Brkt (R) **3** (2) Rail, (1) Runner Block - XY-3 Brkt **4** (2) Rail, (2) Runner Blocks - XY-3 Brkt **5** (1) Rail, (1) Runner Block - XY-2 Brkt (L) **6** (1) Rail, (2) Runner Blocks - XY-2 Brkt (L) **7** No Seal Strip - XY-1 Brkt	**AH** 1mm **AG** 2mm **AX** 5mm **AJ** 10mm **BD** 12mm **AF** 16mm **AW** 25mm	**2** **Standard Nut** **4** Anti-backlash (light preload)	**0** **None** **1** With Seal Strip & XY Bracket	**1** **1 Carriage** **2** 2 Carriages **3** 3 Carriages **4** 4 Carriages NOTE: Contact manufacturer before ordering multiple carriages.

*(L) = Left (R) = Right

####	-	X	X	0

Body Length	(Drive) Knob	Brake	Configuration
mm See page 11 for body length calculation table EX: 90mm = 0090 250mm = 0250	**0** No - shaft only **1** Yes - with knob	**0** No **1** Yes (at drive end)	**0** Standard

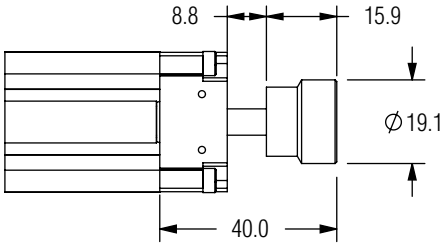
FINAL PART #

MLD028D	-	X	XX	X	X	X	-	XXXX	-	X	X	0

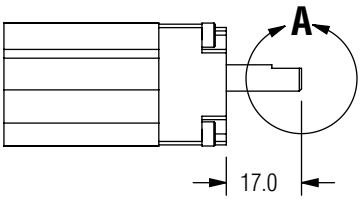
NOTE: Not all combinations are possible. Contact manufacturer for available combinations. Body lengths are available in 1mm increments up to 701mm. Standard lengths are multiples of 10mm. When possible round up to nearest multiple of 10mm. Specifications are subject to change without notice.

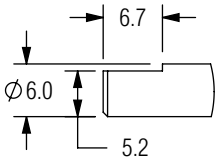
Dimensional Data

KNOB

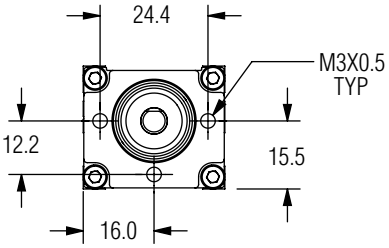


SHAFT ONLY.

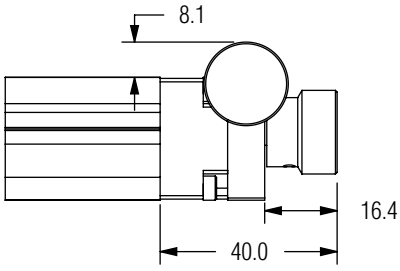


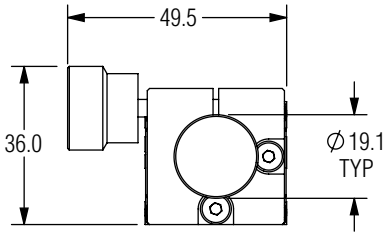


DETAIL A



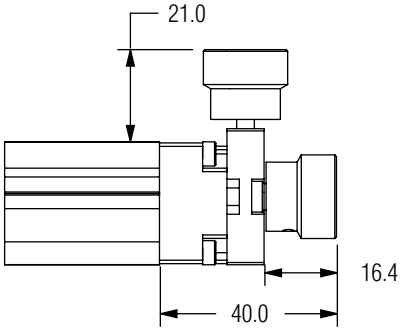
HAND BRAKE SIDE MOUNT

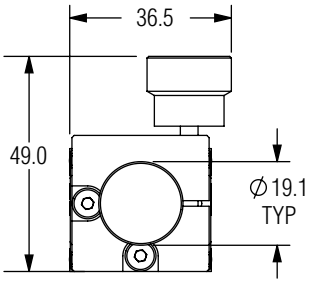




NOTE: Brake installed on side as default and can easily be changed to the top by the customer.

HAND BRAKE TOP MOUNT





MLB Series (Integrated Motor)

- Full stock of open and closed loop stepper motors and servo motors
- Available in NEMA 11,14,17, 23
- Precision machined body
- Small compact design
- High acceleration, speed, and rigidity
- Pre-engineered and assembled for easy installation

MLB Ordering Guide

MLB028D-	X	XX	X	X	X	- ####

Series	Linear Guide Supports*	Lead	Nut Type	Seal Strip	# of Carriages	Body Length
Motor or Lead Screw Driven 28 x 32 mm	**0** No External Rail **1** (1) Rail, (1) Runner Block - XY-2 Brkt (R) **2** (1) Rail, (2) Runner Blocks - XY-2 Brkt (R) **3** (2) Rail, (1) Runner Block - XY-3 Brkt **4** (2) Rail, (2) Runner Blocks - XY-3 Brkt **5** (1) Rail, (1) Runner Block - XY-2 Brkt (L) **6** (1) Rail, (2) Runner Blocks - XY-2 Brkt (L) **7** No Seal Strip - XY-1 Brkt	**AH** 1mm **AG** 2mm **AX** 5mm **AJ** 10mm **BD** 12mm **AF** 16mm **AW** 25mm	**2** Standard Nut **4** Anti-backlash (light preload) **6** Anti-backlash (normal preload)	**0** None **1** With Seal Strip & XY Bracket	**1** 1 Carriage **2** 2 Carriages **3** 3 Carriages **4** 4 Carriages NOTE: Contact manufacturer before ordering multiple carriages.	(mm) See page 11 for body length calculation table EX: 90mm = 0090 250mm = 0250

*(L) = Left (R) = Right

X	X	X	X	XX	0

Motor Location	Motor Make	Motor Frame Size	Motor Power	Motor Feature	Configuration
S Straight **L** Left **R** Right **B** Bottom **T** Top	**1** PBC Linear™ Open loop stepper motor	**B** NEMA 11 (28mm) **C** NEMA 14 (35mm) **F** NEMA 17 (42mm) **G** NEMA 23 (56mm)	**B** Single Stack **C** Double Stack* **D** Triple Stack * not available with NEMA 14	**00** Hybrid wiring (8 wires), flying leads, no encoders [hybrid wiring can be bi-polar or uni-polar]	**0** Standard

FINAL PART #	MLB028D-	X	XX	X	X	X	-	XXXX	-	X	X	X	X	XX	0

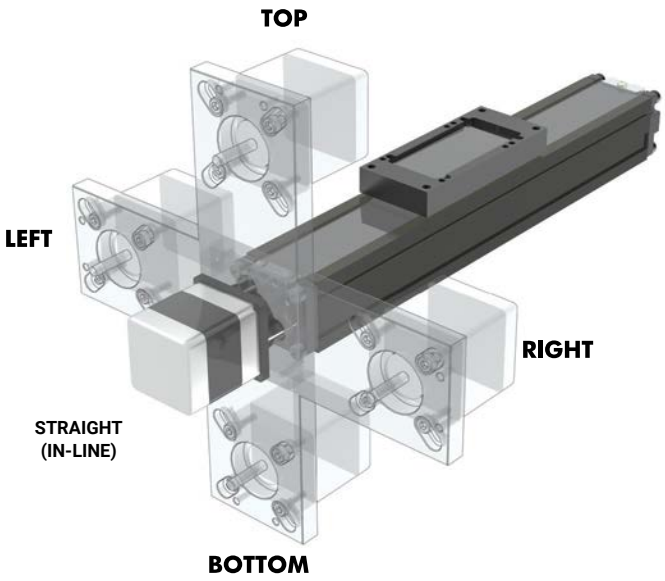
NOTE: Not all combinations are possible. Contact manufacturer for available combinations. Body lengths are available in 1 mm increments up to 701 mm. Standard lengths are multiples of 10 mm. When possible round up to nearest multiple of 10 mm. Longer lead times apply to non-standard lengths. NEMA 11 stepper motors typically do not have enough torque to drive the anti-backlash nuts. Customers are responsible for doing torque calculations to ensure the motor is properly sized. Specifications are subject to change without notice.

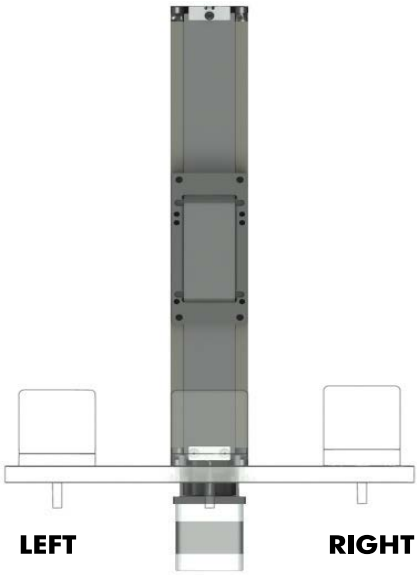
Stepper Motor Options

PBC Linear brand stepper motors are designed to reduce length in the ML actuator. Single, double and triple stack motors are available in each size. See page 18 for dimensional data.

Motor Locations

Using universal motor mounts, PBC Linear's ML series mini-actuators give our customers the freedom for limitless mounting options. Straight (in-line), top, bottom or side motor mounting allows the ML series to fit seamlessly into any specified application.





Wiring Harnesses

Plug Connector included with all Stepper Motor Equipped MLB Series Actuators

Wiring Diagram

Bipolar, Full Step

Step	Phase 1 A	Phase 1 C	Phase 2 B	Phase 2 D
1	+	–	+	–
2	–	+	+	–
3	–	+	–	+
4	+	–	–	+

CW ↓ ↑ CCW

CW & CCW rotation when seen from flange side of the motor.

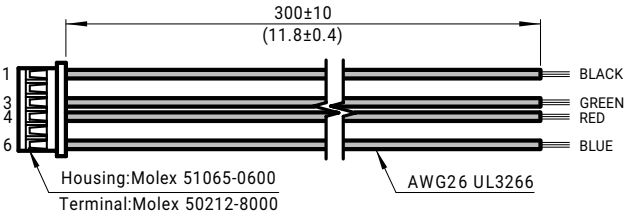
4 Lead (bipolar)

Connector Pin#

Motor Size		
8, 11, 17, 23	14	
1	1	A
3	5	C
4	7	B
6	11	D

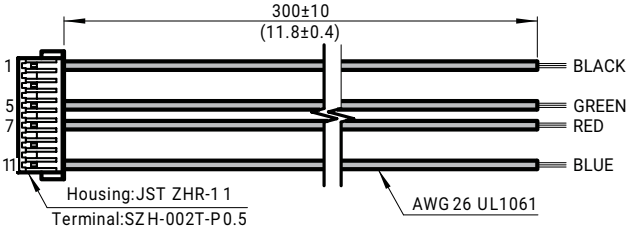
NEMA 11 Series

4 Lead Part Number 6200727



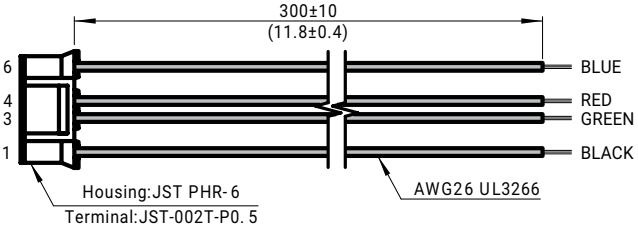
NEMA 14 Series

4 Lead Part Number 6200728



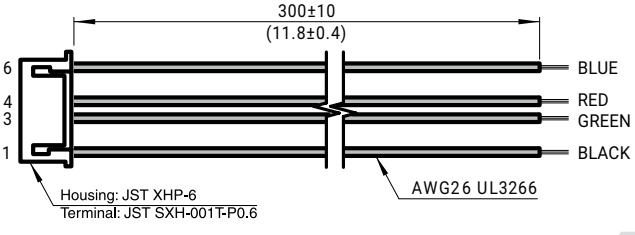
NEMA 17 Series

4 Lead Part Number 6200490



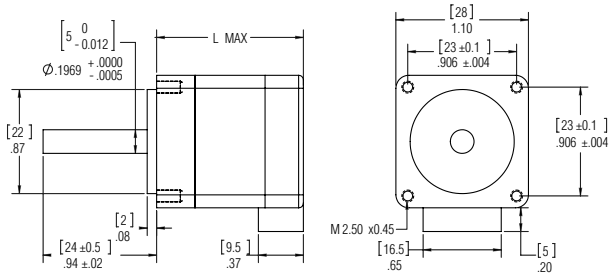
NEMA 23 Series

4 Lead Part Number 6200491

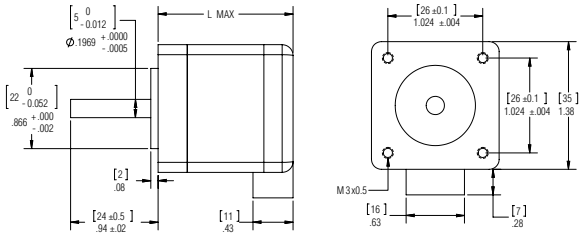


Stepper Motor

NEMA 11 (28mm)

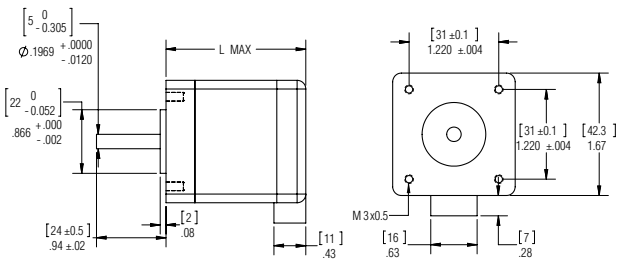


NEMA 14 (35mm)

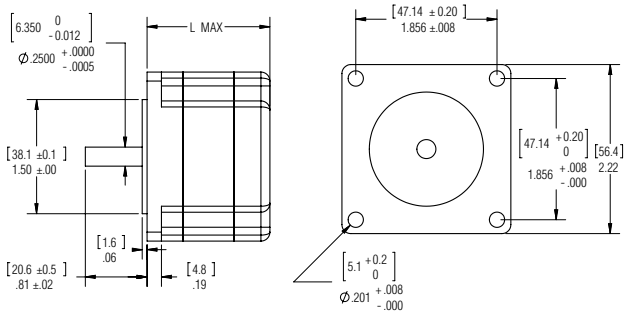


NEMA Rating	Motor Power	Current per Phase	Holding Torque		Detent Torque		Rotor Intertia		Length mm (in)	Weights kg (lb)	Model P/N#
		A	mN • m	oz-in	mN • m	oz-in	g-cm²	oz-in²			
NEMA 11	Single	1	50	7.08	5	0.71	9	0.05	31 (1.21)	0.10 (0.22)	6200297
NEMA 11	Double	0.67	90	12.75	6	0.85	12	0.07	40 (1.56)	0.15 (0.33)	6200298
NEMA 11	Triple	1	100	14.16	8	1.13	18	0.10	51 (2.01)	0.20 (0.44)	6200299
NEMA 14	Single	0.40	60	8.5	10	1.42	12	0.07	26 (1.01)	0.15 (0.33)	6200300
NEMA 14	Triple	0.85	100	14.16	15	2.12	20	0.11	37 (1.44)	0.21 (0.46)	6200302
NEMA 17	Single	1.50	360	50.99	15	2.12	57	0.31	39.8 (1.57)	0.28 (0.62)	6200303
NEMA 17	Double	1.50	490	69.41	25	3.54	82	0.45	48.3 (1.90)	0.36 (0.79)	6200304
NEMA 17	Triple	1.50	630	89.24	30	4.25	123	0.68	62.8 (2.47)	0.60 (1.32)	6200305
NEMA 23	Single	1.50	500	70.82	22	3.12	135	0.74	41 (1.61)	0.42 (0.93)	6200306
NEMA 23	Double	1.50	1000	141.64	40	5.66	260	1.43	54 (2.13)	0.60 (1.32)	6200307
NEMA 23	Triple	1.40	1650	233.71	70	9.91	460	2.53	76 (2.99)	1.00 (2.20)	6200308

NEMA 17 (42mm)



NEMA 23 (56mm)

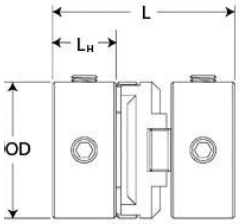


Motor Couplings

Motor Coupling (HUB & Disk)

- Compensates for motor and screw misalignment
- Electrically isolating
- Balanced design

HUB



Disk

FOR USE WITH NEMA 11, 14, 17 MOTORS

HUBS P/N #	Bore*	OD	HUB Length (LH)	Coupling Length (L)	Shaft Penetration	Set Screw	Moment of Inertia (lb-in^2)	Moment of Inertia (kg x m^2)
6200129	3 mm	12.7 mm	5.6 mm	15.9 mm	5.6 mm	M3	0.0056"	1.64E-06
6200286	5 mm	12.7 mm	5.6 mm	15.9 mm	5.6 mm	M3	0.0050"	1.47E-06
6200350	6 mm	12.7 mm	5.6 mm	15.9 mm	5.6 mm	M3	0.0047"	1.37E-06
6200113	0.125"	0.500"	0.222"	0.625"	0.222"	M3	0.0056"	1.64E-06
6200349	0.250"	0.500"	0.222"	0.625"	0.222"	M3	0.0045"	1.32E-06

For Use with NEMA 23 Motors Only

HUBS P/N #	Bore*	OD	HUB Length (LH)	Coupling Length (L)	Shaft Penetration	Set Screw	Moment of Inertia (lb-in^2)	Moment of Inertia (kg x m^2)
6200130	4 mm	19.1 mm	7.6 mm	22.2 mm	7.6 mm	M3	0.0069	2.02E-06
6200131	5 mm	19.1 mm	7.6 mm	22.2 mm	7.6 mm	M3	0.0068	1.99E-06
6200132	6 mm	19.1 mm	7.6 mm	22.2 mm	7.6 mm	M3	0.0066	1.94E-06
6200133	8 mm	19.1 mm	7.6 mm	22.2 mm	7.6 mm	M3	0.0061	1.79E-06
6200114	0.1875"	0.750"	0.300"	0.875"	0.300"	M3	0.0068	1.99E-06
6200115	0.2500"	0.750"	0.300"	0.875"	0.300"	M3	0.0065	1.91E-06
6200116	0.3125"	0.750"	0.300"	0.875"	0.300"	M3	0.0062	1.82E-06

*Contact PBC linear if required bore is not listed.

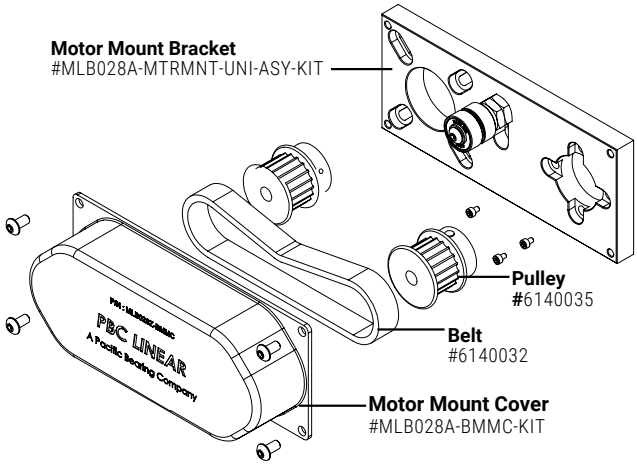
Disk P/N #	Material	OD		Torsional Stiffness		Rated Torque		Brake Torque		Parallel Misalignment		Axial Motion		Moment of Inertia (kg x m^2)
		(mm)	(in)	(Deg/ Nm)	(Deg /lb-in)	(Nm)	(lb-in)	(Nm)	(lb-in)	(mm)	(in)	(mm)	(in)	
6200148	Acetal	12.7	0.50	0.636	0.072	0.69	6	3.9	34	0.1	0.004	0.05	0.002	2.93E-08
6200149	Acetal	19.1	0.75	0.38	0.043	2.25	20	10.5	93	0.2	0.008	0.10	0.004	5.87E-08

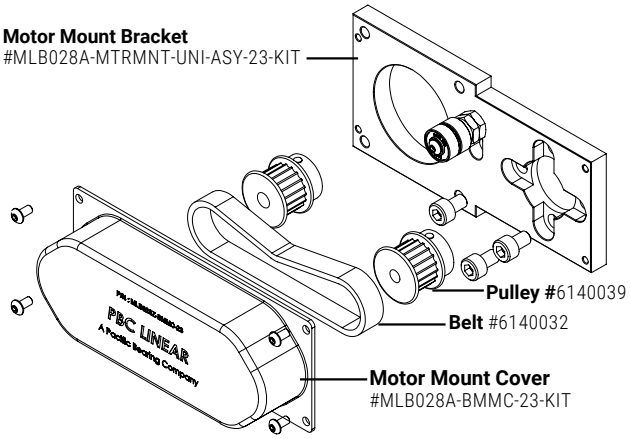
NOTE: Motor coupling assembly (hubs & disk) are included in MLB & MLC Series actuators. One hub of the coupling is integral to the lead screw drive system. Alternate coupling styles are not available

Ordering Accessories

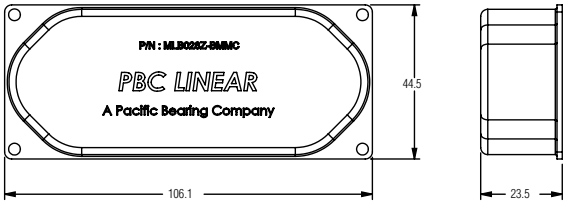
When ordering ML accessories, use the part number (P/N) to specify which accessory you want when placing your ML actuator order. If you have technical question contact a PBC Linear Application Engineer at at **1-800-962-8979.**

Motor Mount Assembly - Replacement Parts



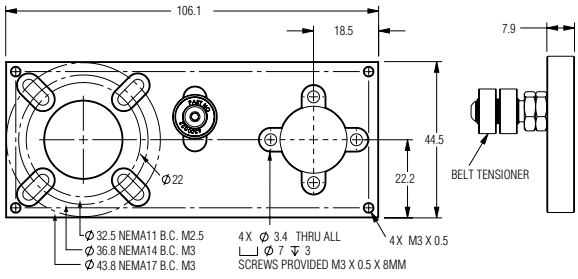


Motor Mount Assembly - NEMA 11/14/17



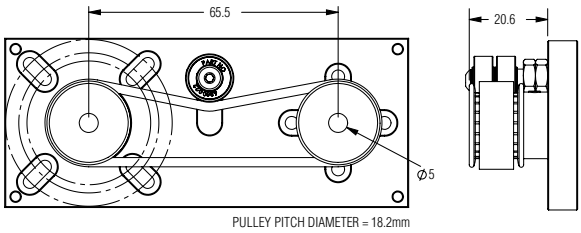
Includes:

(1) Motor Mount Cover (4) BHCS M3 x 0.5 x 6 mm	P/N: **MLB028A-BMMC-KIT**



Includes:

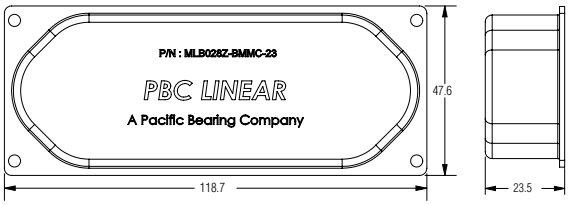
(1) Motor Mount Bracket (3) SHCS M3 x 0.5 x 8 mm	P/N: **MLB028A-MTRMNT-UNI-ASY-KIT**



Includes:

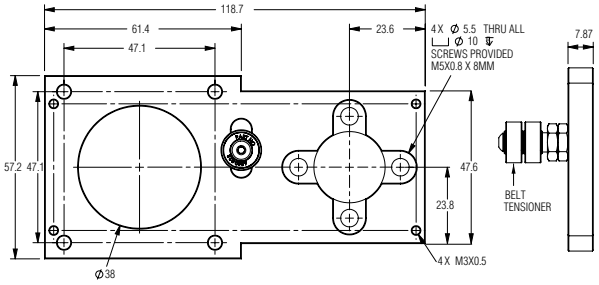
(1) Pulley Belt (3 mm pitch)	P/N: **6140032**
(2) Timing Pulley, 9 mm x 5 mm	P/N: **6140035**

Motor Mount Assembly - NEMA 23



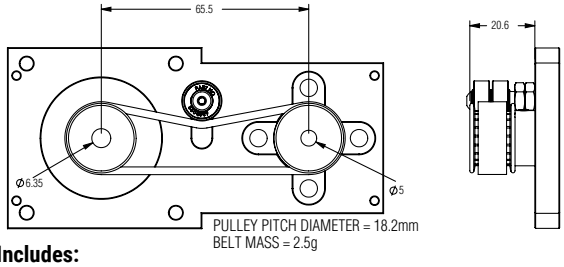
Includes:

(1) Motor Mount Cover (4) BHCS M3 x 0.5 x 8 mm	P/N: **MLB028A-BMMC-23-KIT**



Includes:

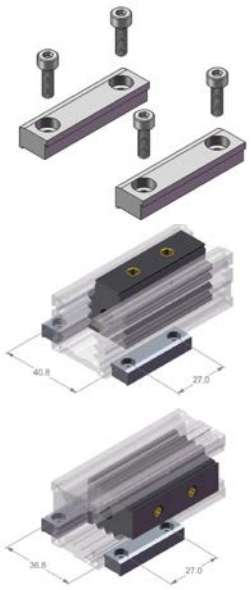
(1) Motor Mount Bracket (3) SHCS M5 x 0.8 x 8 mm	P/N: **MLB028A-MTRMNT-UNI-ASY-23-KIT**



Includes:

(1) Pulley Belt (3 mm pitch)	P/N: **6140032**
(1) Timing Pulley, 9mm x 6.35 mm	P/N: **6140039**
(1) Timing Pulley, 9 mm x 5 mm	P/N: **6140035**

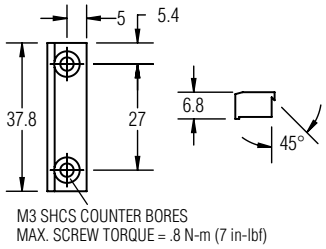
Mounting Hardware (Clamps, Plates & Sensor Kits)



Dovetail Clamps

Two screw design helps ensure quick and easy alignment during installation.

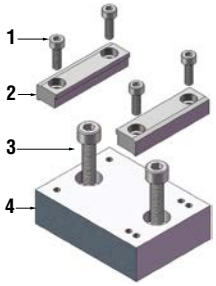
Kit Includes:
(2) M3 Dovetail Clamp
(4) M3 x 10mm SHCS

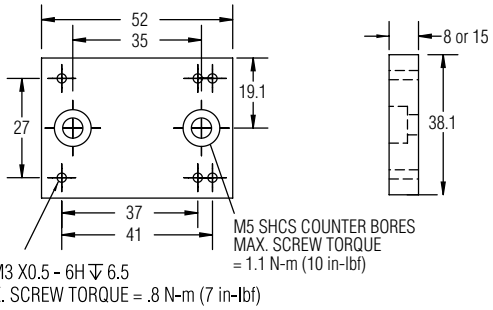


Single Dovetail Clamp Only	P/N: **MLA028A-HDC-M3**
Dovetail Clamp Kit	P/N: **MLA028A-HDC-M3-KIT**

Riser Plates

Includes:
1. (4) M3 x 10mm SHCS
2. (2) M3 Dovetail Clamp
3. (2) M5 x 16mm SHCS
4. (1) 8mm or 15mm Riser Plate





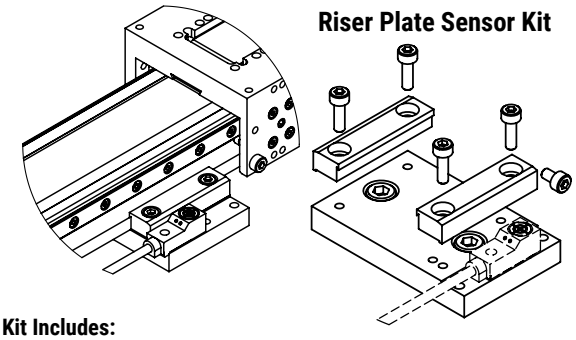
Recommended for NEMA 14 & 17 Motor

8 mm Riser Plate only	P/N: **MLA028A-RSRPLT-08**
8 mm Riser Plate Kit	P/N: **MLA028A-RSRPLT-08 -KIT**

Recommended for NEMA 23 Motor

15 mm Riser Plate only	P/N: **MLA028A-RSRPLT-15**
15 mm Riser Plate Kit	P/N: **MLA028A-RSRPLT-15-KIT**

Riser Plate Sensor Kit

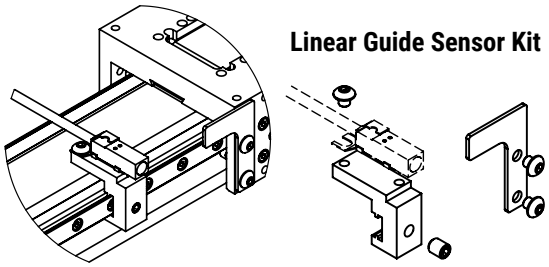


Kit Includes:
(1) Riser plate (8 or 15mm)
(4) M3 x 10mm screws
(1) M3 x 6mm screw
(2) Dovetail clamps
(1) M3 x 12mm screw
(2) M5 x 16mm screw (optional)

Compatible Sensors: OM-E2S-W2 style)
Typical Applications: ML Actuator gantry's with (2) linear guides

Riser Plate Sensor Kit	P/N: **MLA028A-RSRPLT-08A-KIT**
Riser Plate Sensor Kit	P/N: **MLA028A-RSRPLT-15A-KIT**

Linear Guide Sensor Kit

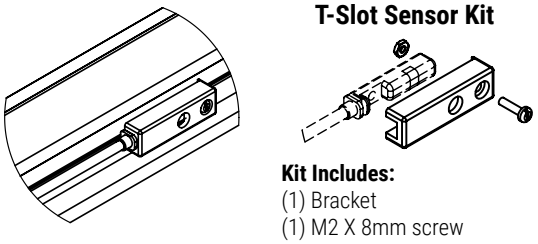


Kit Includes:
(1) Bracket
(1) OM-Y92E-C1R6 Bracket
(3) M3 X 4mm screws
(1) M4 X 5mm set screw
(1) Flag, 5mm sensing distance

Compatible Sensors: OM-E2S-Q1 style
Typical Applications: ML Actuators with one or two linear guide(s)

Linear Guide Sensor Kit	P/N: **MLB028A-BRKTA-KIT**

T-Slot Sensor Kit



Kit Includes:
(1) Bracket
(1) M2 X 8mm screw
(1) M2 nut

Compatible Sensors: PBC Linear 6200XXX Series Sensors
Typical Applications: ML Actuator with zero or one linear guide(s)

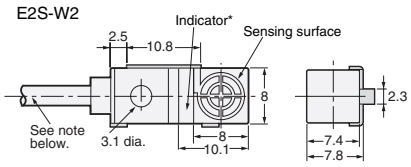
T-Slot Sensor Kit	P/N: **MLA028A-SENADT-KIT**

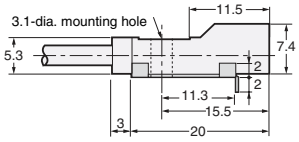
*** Note:** Sensor mounting kits do not include a sensor. The appropriate sensor should be ordered separately.

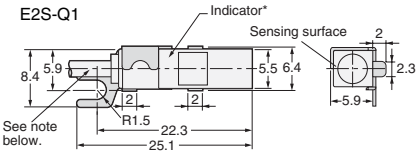
Proximity Sensors

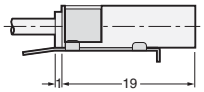
Super Compact Proximity Sensors

OM-E2S-W2
OM-E2S-Q1





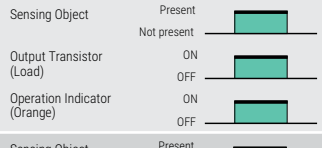
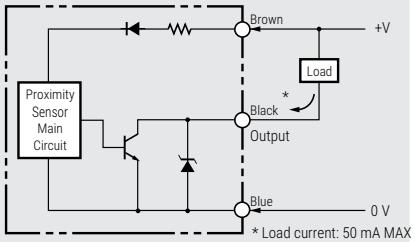
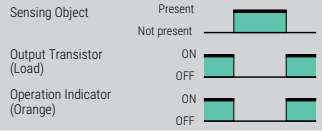
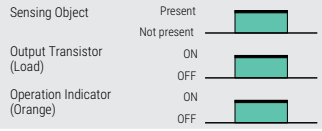
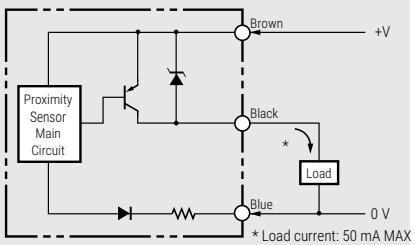
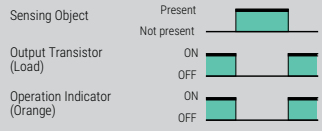




NOTE: 2.9-dia. vinyl-insulated round cable with 2/3 conductors. (Conductor cross section: 0.14 mm^2, Insulator diameter: 0.9 mm), Standard length: 1m

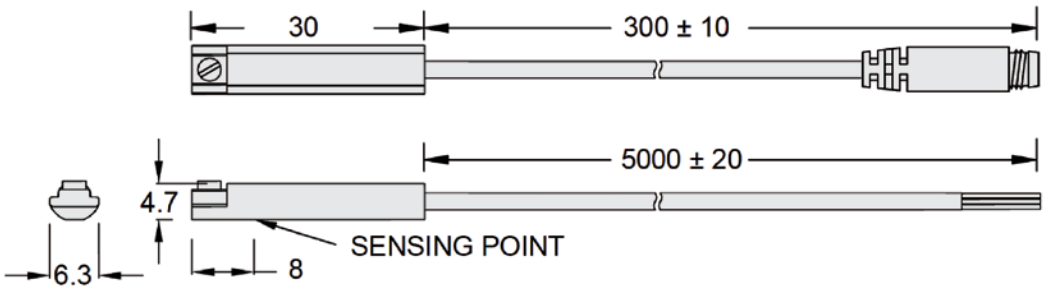
Sensing Surface	Sensing Distance	Sensor Series	Output Configuration	Cable: 5 m Flying Lead		Cable: 275 mm M8 Quick Disconnect	
				Normally Open (NO)	Normally Closed (NC)	Normally Open (NO)	Normally Closed (NC)
End	1.6 mm	**OM-E2S-Q**	NPN	OM-E2S-Q13-☐	**OM-E2S-Q14-5M**	OM-E2S-Q13-U2	**OM-E2S-Q14-U2**
			PNP	OM-E2S-Q15-☐	OM-E2S-Q16-5M	OM-E2S-Q15-U2	OM-E2S-Q16-U2
Front/Top	2.5 mm	**OM-E2S-W**	NPN	OM-E2S-W23-☐	**OM-E2S-W24-5M**	OM-E2S-W23-U2	**OM-E2S-W24-U2**
			PNP	OM-E2S-W25-☐	OM-E2S-W26-5M	OM-E2S-W25-U2	OM-E2S-W26-U2
Bottom	n/a	**PBC Linear 6200XXX**	NPN				
			PNP				

☐ = length of cable 5M" = 5 meters with flying lead; U2 = 275mm with quick disconnect

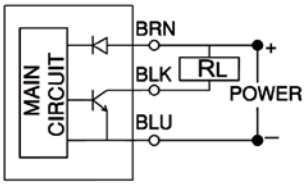
Operation Status	Output Configuration	P/N #	Timing Chart	Output Circuits
NO	NPN	OM-E2S-W23-☐ OM-E2S-Q13-☐		
NC	NPN	OM-E2S-W24-☐ OM-E2S-Q14-☐		
NO	PNP	OM-E2S-W25-☐ OM-E2S-Q15-☐		
NC	PNP	OM-E2S-W26-☐ OM-E2S-Q16-☐		

Magnetic Sensor Switch Specifications

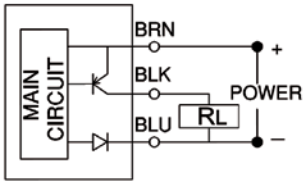
Dimensional:



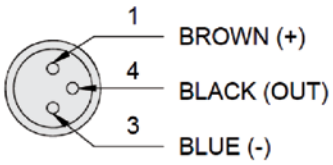
Schematics:



NPN (Current Sinking)



PNP (Current Sourcing)



Pinout

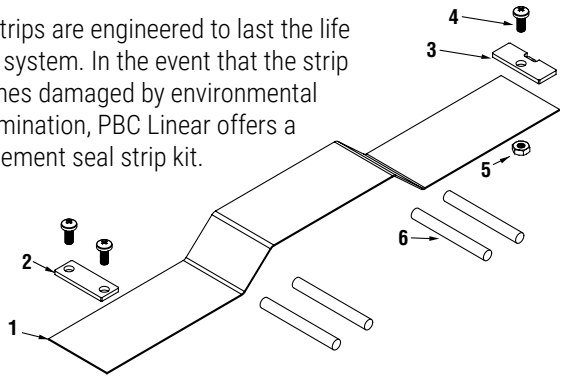
Type	6200096	6200154	6200153	6200155	6200269	6200270	6200271	6200272
End Connector	Quick Disconnect				Wire			
Wire Length	300 mm				5 m			
Sensor Type	NPN		PNP		NPN		PNP	
Switching Logic (Solid State Output)	NC	NO	NC	NO	NC	NO	NC	NO
Operative Voltage	10–30V DC							
Switching Current	200 mA MAX							
Contact Rating	6 W MAX							
Current Consumption	20 ma @ 24V DC MAX							
Voltage Drop	1.5V MAX							
Leakage Current	0.05 mA MAX							
Cable	Ø3 mm, 3 wire, polyurethane							
Indicator	Red	Yellow	Yellow	Yellow	Red	Yellow	Yellow	Yellow
Operating Frequency	1000 Hz							
Magnet Requirement (Note 1)	50	65	50	65	50	65	50	65
Temperature Range	-10–70˚C (+14–158˚F)							
Shock (Note 2)	50 g							
Vibratin (Note 3)	9 g							
Enclosure Classification	IEC 529 IP 67 (NEMA 6)							
Protection Circuit	Reverse polarity, Short-circuit							

Notes: 1. Units: Gauss Parallel. Measuring standard target: Ø15.5 x Ø8 x 5t (Anisotrophy rubber magnet)
2. Sine wave • X Y Z three directions • three times each direction • 11 ms each time
3. Double amplitude 1.5 mm • 10Hz–55Hz–10Hz (Sweep 1 min.) • X Y Z three directions • 1 hour each time

Model P/N:		OM-E2S-W13 OM-E2S-W14	OM-E2S-W23 0M-E2S-W24	OM-E2S-Q15 OM-E2S-Q16	OM-E2S-W25 0M-E2S-W26
Sensing surface		Front	Top	Front	Top
Sensing distance		1.6 mm ± 15%	2.5 mm ± 15%	1.6 mm ± 15%	2.5 mm ± 15%
Set distance		0 to 1.2 mm	0 to 1.9 mm	0 to 1.2 mm	0 to 1.9 mm
Differential travel		10% MAX of sensing distance			
Detectable object type		Ferrous metal			
Standard target object		Iron, 12 x 12 x 1 mm	Iron, 15 x 15 x 1 mm	Iron, 12 x 12 x 1 mm	Iron, 15 x 15 x 1 mm
Response frequency (see note)		1 kHz min.			
Power supply voltage (operating voltage range)		12 to 24V DC, ripple (p-p): 10% max., (10 to 30V DC)			
Current Consumption		13 mA max. at 24 VDC (no-load)			
Operation Mode (with sensing object approaching)		OM-E2S-_ _ 3 models: NO OM-E2S-_ _ 4 models NC			
Control Output	**Load Current**	NPN open collector output 50 mA max. (30 V DC max)		PNP open collector output 50 mA max. (30 V DC max.)	
	Residual voltage	1.0 V max. with a load current of 50 mA and a cable length of 1 m			
Indicator		Operation indicator (orange)			
Protection Circuits		Reverse polarity connection and surge absorber			
Ambient temperature	**Operating**	-25°C to 70°C (-13°F to 158°F) with no icing or condensation			
	Storage	-40°C to 85°C (-40°F to 185° F) with no icing or condensation			
Ambient humidity	**Operating**	35% to 90% (with no condensation)			
	Storage	35% to 95% (with no condensation)			
Temperature influence		± 15% max. of sensing distance at 23° in the temperature range of -25 to 70° C			
Voltage Influence		± 2.5% MAX of sensing distance in rated voltage range ± 10%			
Insulation resistance		50 M MIN (500V VDC) between current carry parts and case			
Dielectric strength		1,000 VAC, 50/60 Hz for 1 min between current carry parts and case			
Vibration resistance		Destruction: 10 to 55 Hz, 1.0 mm double amplitude for 2 hours each in X, Y and Z directions			
Shock resistance		Destruction: 500 m/s² (1640 ft/s²) 3 times each in X, Y and Z directions			
Connection Method		Pre-wired standard length 1 m (39.37 in)			
Weight (packed state)		Approx. 10 g (0.35 oz)			
Material/Case		Polyarylate resin			

Maintenance Kit System Parts • Seal Strip Kit

Seal strips are engineered to last the life of the system. In the event that the strip becomes damaged by environmental contamination, PBC Linear offers a replacement seal strip kit.



Kit Includes: *(Carriage bracket sold separately.)*

1. (1) Seal Strip - Ultra-wear resistant MDS nylon
2. (1) Retainer Bracket
3. (1) Adjuster Bracket
4. (3) PHC M2 x 0.4 x 5 mm
5. (1) Hexagon Nut, M2 x 0.4
6. (4) Bearings

Seal Strip Kit	P/N: **MLA028A-SSAR-KIT**

Seal strip is 725 mm in length and can be cut shorter using sharp pair of scissors.

Application Data Sheet

FAX COMPLETE FORMS TO:
1(815) 389-5790

RFQ:_____

Date:_____

Company:_____

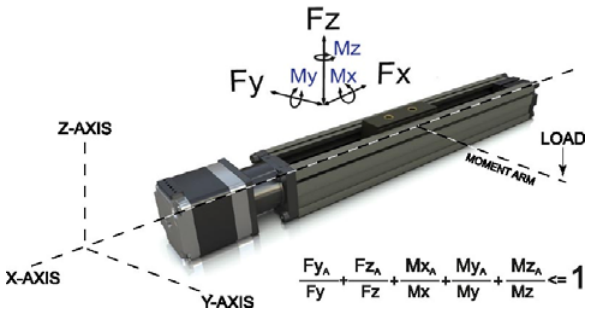
Contact:_____

Address:_____

_____

Phone:_____

E-mail:_____



APPLICATION DESCRIPTION – *Sketch if available.*

Project Name:_____ Project Status: ❑ Concept ❑ Design ❑ Prototype ❑ Existing

Project Description: _____

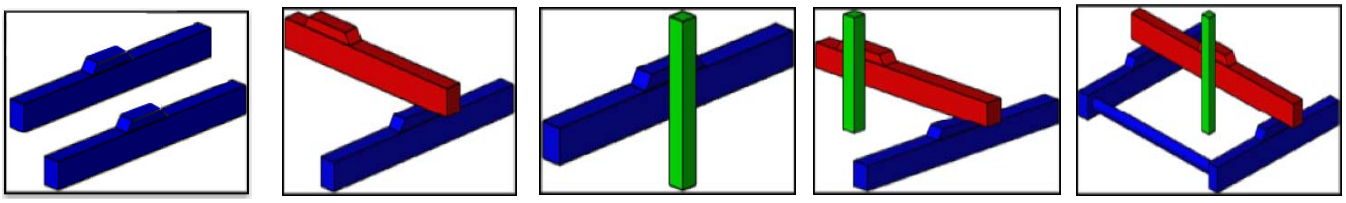
Project Timing:_____ Target Pricing:_____

Quantity:_____ Components: ❑ Actuator Only ❑ Actuator/Motor ❑ Accessories_____

Environment: ❑ Clean Room ❑ General Shop ❑ Heavy Industrial ❑ Food/Washdown ❑ High Vibration ❑ Other_____

SYSTEM TYPE

❑ Single Axis ❑ X-Y Axis ❑ Y-Z Axis ❑ X-Y-Z Axis ❑ X1/X2-Y-Z Axis



Axi $\frac{Fy_A}{Fy}+\frac{Fz_A}{Fz}+\frac{Mx_A}{Mx}+\frac{My_A}{My}+\frac{Mz_A}{Mz}<=1$ s Orientation: ❑ Vertical ❑ Horizontal ❑ Inverted ❑ Angled

	AXIS		
	X	**Y**	**Z**
Load N (lbf)			
Moment Nm (lbf-in)			
Stroke mm (in)			
Velocity mm/s (in/s)			
Acceleration m/s^2 (ft/s^2)			
Deceleration m/s^2 (ft/s^2)			

Comments:

_____

_____

_____

_____

_____

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Engineering Your Linear Motion Solutions

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Range of Offerings

Components

Mechatronics

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LITLAT-002 v4 (04-2021)